Deep Seafloor

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- ♦ *Priority Issues*:
  - Role of temporal environmental variability (including disturbance)
  - Anthropogenic effects (past and present)
  - Mass material transport (sediment transport / submarine hydrology)
  - Characterize benthic habitats and communities
  - Canyon dynamics
  - Sustainable fisheries
  - Natural geohazards

- ♦ *Characterization of Priority Questions*:

What are the impacts of bottom trawling and other fishing gear on benthic habitats and communities?
Parameters - Impact of selective removal of organisms and impact of disturbance to substrate
Methods - Assess rates of community recovery by monitoring size, abundance, reproduction, of benthic megafauna, assess physical substrate recovery
Spatial Scale - Define appropriate scale for selected habitat types based on community structure, depth and chemistry; Intensively study shelf areas likely to be fished/impacted
Temporal Scale - Impacts are on a very short time scale but recovery may take decades
Frequency - Sampling frequency should coincide with expected rates of disturbance
Existing Data/Programs - Trawling log books, some published data

What are the impacts of bottom seafloor cables on benthic habitats and communities?
Parameters - Examine mega and macrofuana abundance and distribution before and after cable installation; Examine disturbance to benthic habitats (plowing/erosion), changes in chemical gradients of oxygen, sulfide
Methods - Seafloor mapping/surveys/sampling with ROV, trawls and grabs impacted and control sites
Spatial Scale - Replicate stations in impacted habitat types (e.g., sedimentary, rocky).

Temporal Scale - Single survey before installation and repeat surveys after disturbance until communities recover to background levels
Frequency - Annually, some parameters more often
Existing Data/Programs - MCI and other cable surveys

What are the impacts of chemical pollutants / contaminants on benthic habitats and communities?
Parameters - Distribution of contaminants in sediments, ground waters and in tissues of fauna (DDT, PCB, trace metals)
Methods - Standard sediment and tissue sampling techniques
Spatial Scale - In the vicinity of know contaminant sources, dependent on events
Frequency - Annually, some parameters more often

What are the seasonal, interannual, and longer time scales of environmental variability in the distribution and abundance of habitats and organisms?
Parameters - Fauna: mega and macro faunal abundance, size, reproductive condition and factors such as chemical tracers and pollutants in tissues. Habitat: physical and chemical variability in currents, turbidity, temperature, oxygen, chlorophyll or carbon input, and pollution or tracers.
Methods - Fauna using seafloor surveys/sampling with ROV, trawls and grabs; Habitat using mapping, moorings, landers, surveys with current meters, optical sensors (back scatter and chlorophyll), temperature and oxygen sensors; Kelp input using ROV/trawl surveys
Spatial Scale - Replicate stations stratified among defined habitat types such as continental shelf, slope, rise, canyon axis, canyon walls, abyssal plane
Temporal Scale - Monthly to annual, depending on parameter
Frequency - Sampling/study may be focused on particular interesting oceanographic or anthropogenic variability (e.g., ENSO, oil spill)
Existing Data/Programs - MBARI benthic surveys, limited benthic flux studies, NOAA trawl surveys

What is the role of natural / designated harvest refugia?
Parameters - Distribution, abundance, size/age class and reproductive condition of fish and macro invertebrates; Biodiversity (non-target species), larval transport combined with oceanographic parameters, adult spillover effects, substrate conditions
Methods - Identify existing natural harvest refugia, establish no-take areas for long-term monitoring, control site comparisons, ROV video/still photos and bottom grabs
Spatial Scale - Depends on species of interest, life history requirements, network of small areas or few large areas and control sites
Temporal Scale and Frequency - Spawning cycles and other critical life history stages, determined by species
Existing Data/Programs - USGS habitat maps, trawl logbooks, data on no-take zones
Additional Comments - Marine Reserve Committee of PFMC and NCCES group

What is the paleo-oceanographic context of present day variability?
Parameters - Past environmental changes as recorded in layered sediments
Methods - Depth transects of sediment cores across margin

Spatial Scale - Various environments that differ in terms of sedimentation rate and depth, continental shelf, slope, rise, canyon axis, and abyssal plane
Temporal Scale - Current to 10,000 years is the highest priority with current to 100,000 and 1 million years lower priority
Frequency - Core samples may only need to be collected once
Existing Data/Programs - Some core samples already exist at MBARI and USGS
Additional Comments - Significant efforts in using specific techniques to establish sediment ages, environmental proxies and sediment dynamics are also needed

What are the sources and sinks of carbon and other material in the Sanctuary?
Parameters - Establish budgets, sedimentation (inorganic and organic) rates, erosion rates, distribution of processes, coupled with source inputs
Methods - Moorings to establish physics and dynamics, cores for geochronological analysis and benthic moorings
Spatial Scale - Static view, seasonal when appropriate, event response
Temporal Scale - Combine with paleo-oceanographic studies
Existing Data/Programs - Some data at MBARI and USGS

How do canyon dynamic processes and material transport affect the carbon and material budget?
Parameters - Flow velocities, temperature, salinity, oxygen, turbidity and biological and geological characterization
Methods - Time series of current meter, CTD, video, bottom coring, acoustic bottom characterization
Spatial Scale - Canyon head to fan, selected sites of time series along axis, 1 m resolution for bottom sampling
Temporal Scale - One to 10 years at one-hour resolution for field sensors
Existing Data/Programs - some at MBARI, USGS and NPS